Case Report

Refractory paroxysmal sympathetic hyperactivity following brain injury in a pregnant woman that dramatically improved after delivery

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Case: A 16-year-old primiparous girl in the 11th week of gestation presented to our hospital with a traumatic brain injury suffered during a motorcycle accident. She was comatose on arrival to the hospital and was admitted to the intensive care unit. From day 2, she developed intermittent episodes of tachycardia with tachypnea, fever, profuse sweating, and extensor posturing. She was diagnosed with paroxysmal sympathetic hyperactivity (PSH) and treated with morphine. However, paroxysmal sympathetic hyperactivity could not be controlled and her general condition deteriorated. Intrauterine fetal death was confirmed in the 16th week of gestation, on day 37 of hospitalization. P paroxysmal sympathetic hyperactivity increased each day until delivery and dramatically improved after delivery.

Outcome: The patient gradually regained consciousness and was discharged to a rehabilitation hospital on day 117 after hospitalization.

Conclusion: Pregnancy is a risk factor for paroxysmal sympathetic hyperactivity exacerbation, and delivery can result in resolution of the condition.

Key words: Head injury, intensive care unit, paroxysmal sympathetic hyperactivity, pregnancy, trauma

INTRODUCTION

PAROXYSMAL SYMPATHETIC HYPERACTIVITY (PSH) is a relatively uncommon complication of various central nervous system injuries. It is characterized by paroxysms of fever, hypertension, tachycardia, tachypnea, diaphoresis, and dystonic posturing. Although multiple diagnostic criteria for PSH have been published and clear diagnostic standards do not exist,[1] diagnostic criteria proposed by Rabinstein[2] (Table 1) are generally followed. In recent years, an increasing number of PSH cases have been reported, leading to increased recognition.[3–6]

However, there are no reports of PSH during pregnancy; therefore, the effects of pregnancy on PSH remain unknown and the management of PSH in pregnant women remains to be established. Here, we report a case involving a 16-year-old primiparous girl in the 11th week of gestation who developed refractory PSH following brain injury in a motorcycle accident and exhibited PSH resolution after delivery.

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CASE

A 16-YEAR-OLD PRIMIPAROUS GIRL in the 11th week of gestation was transported to our hospital with a traumatic brain injury after a motorcycle accident. She was comatose with a Glasgow Coma Scale score of 5 (E1V1M3) and intubated at the accident scene. On arrival to our hospital, her vital signs were normal, although she did not regain consciousness. Pertinent neurological findings included coma with decerebrate posturing, absence of eye reflexes in response to pain, anisocoria, and abnormal light reflexes. Head computed tomography revealed left temporal lobe and corpus callosum contusion without mass effect signs or a midline shift, subarachnoid haemorrhage in the basal cisterns, and fracture of the mandible. Brain magnetic resonance imaging was carried out, and diffuse petechial

Table 1. Diagnostic criteria for paroxysmal sympathetic hyperactivity proposed by Rabinstein[2]

Fever	>38.3°C on at least one measurement for 2 consecutive days
Tachycardia	HR >120 b.p.m. or >100 b.p.m. if the patient was treated with β-blocker
Hypertension	SBP >160/mmHg or pulse pressure >80/mmHg
Tachypnea	RR >30 breaths/min
Excessive diaphoresis	
Extensor posturing or sever dystonia	

Paroxysmal sympathetic hyperactivity is diagnosed by the transient presence of four of the six criteria in the absence of other potential causes for these clinical signs. HR, heart rate; RR, respiratory rate; SBP, systolic blood pressure.

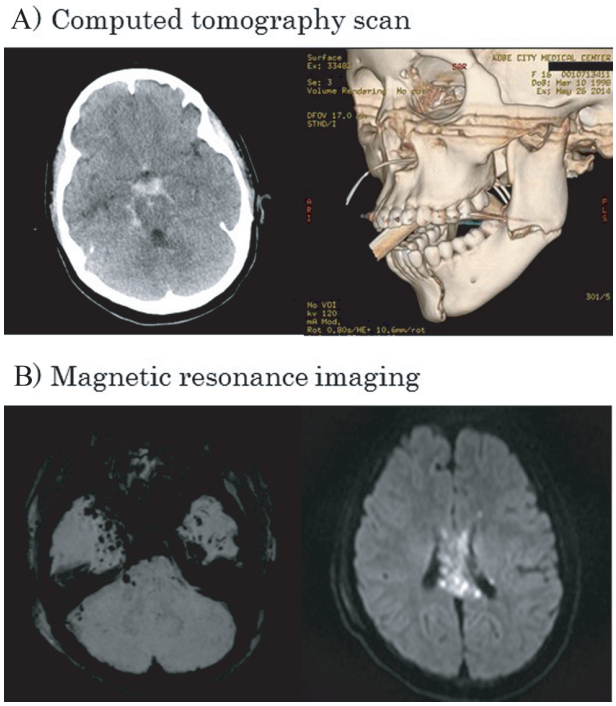

Fig. 1. Head computed tomography and magnetic resonance imaging findings in a 16-year-old primiparous girl in the 11th week of gestation who was transported to our hospital in a comatose state with decerebrate posturing after a motorcycle injury. (a) Computed tomography on day 1 reveals left temporal lobe and corpus callosum contusion without mass effect signs or a midline shift, and subarachnoid haemorrhage in the basal cisterns (left), and fracture of the mandible (right). (b) Magnetic resonance imaging on day 2 shows diffuse petechial hemorrhage in the basal temporal lobe on fluid-attenuated inversion recovery imaging (left) and high signal intensity in the corpus callosum on diffusion-weighted imaging (right).

hemorrhage in the basal temporal lobe was observed on fluid-attenuated inversion recovery imaging and high signal intensity in the corpus callosum was observed on diffusion-weighted imaging (Fig. 1). Abdominal ultrasound showed no evidence of damage to the fetus. Her diagnosis on admission was diffuse axonal injury, brain contusion, traumatic subarachnoid haemorrhage, and mandibular fracture. After initial therapy, she was admitted to the intensive care unit.

Her intracranial pressure was well controlled without any interventions (initial intracranial pressure, 5 mmHg; cerebral perfusion pressure, 77 mmHg). On day 3, she underwent open reduction and internal fixation for the mandibular fracture and tracheotomy. Subsequently, her general condition improved, and she was discharged from the intensive care unit on day 11; however, she developed intermittent episodes of tachycardia with tachypnea, fever, profuse sweating, and extensor posturing, from day 2. Convulsions were initially suspected; however, electroencephalography revealed no epileptiform discharge, and her clinical course was not consistent with that of convulsions. Various culture tests were then carried out to rule out infection, the results of which were negative. Withdrawal syndrome associated with the use of sedatives was also ruled out because she was not treated with any sedative except a small amount of fentanyl for pain relief. Taken together, her symptoms met the diagnostic criteria for PSH proposed by Rabinstein, and she was diagnosed with PSH on day 10. Because we were concerned about the impact on her fetus, we selected morphine, which is safe for pregnant women, as a treatment drug for PSH. However, the PSH could not be controlled, and profuse sweating caused dehydration and electrolyte disturbances despite a large amount of infusion and electrolyte correction. Although the fetus was in good health until day 25, amniotic fluid reduction was confirmed on day 31 and intrauterine fetal death (IUFD) was confirmed at 16 weeks of gestation, on day 37. The attending obstetrician recommended waiting for spontaneous expulsion of the dead fetus, because poor PSH control and an extremely poor general condition ruled out surgery. Accordingly, we waited for spontaneous delivery and did not implement any changes in her medication that could affect the fetus until delivery. However, her PSH symptoms worsened with each passing day. Hence, we decided to perform dilation and curettage on day 51. Immediately after delivery, although her symptoms did not completely disappear, they showed a significant improvement (Fig. 2 the average duration of PSH symptoms is 13.7 days (maximum, 32 days) in survivors and discharged patients; however, the duration of this condition in our patient was 80 days.

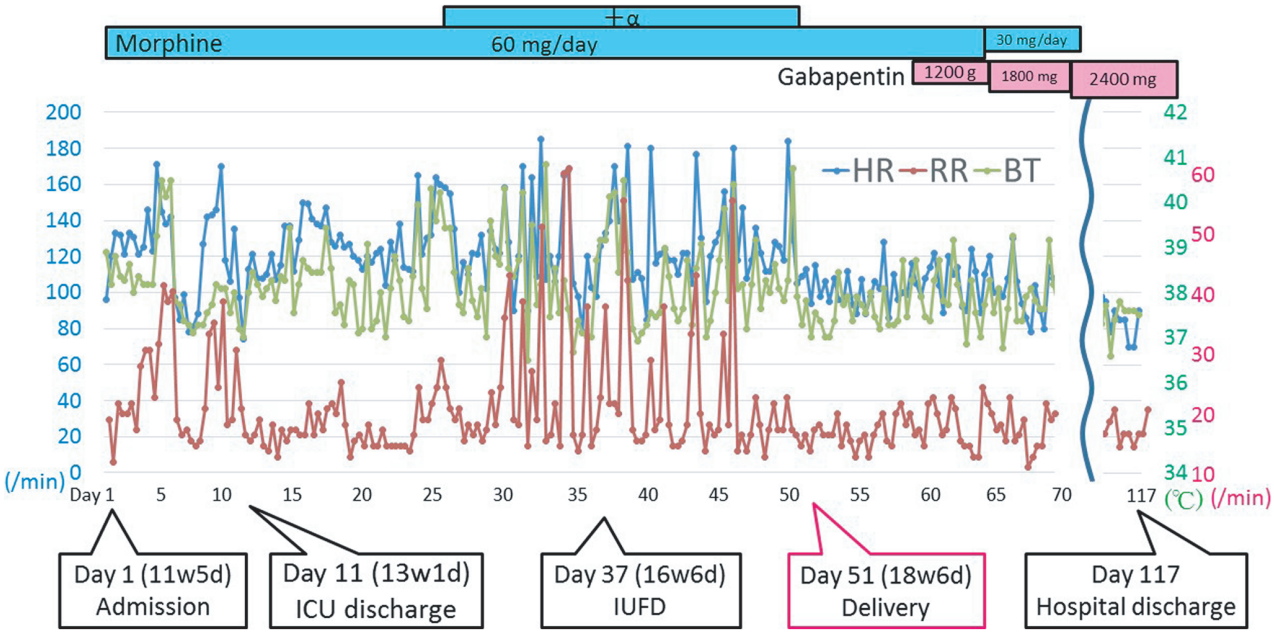

Fig. 2. Clinical course of a 16-year-old pregnant girl with traumatic brain injury and refractory paroxysmal sympathetic hyperactivity. Paroxysmal sympathetic hyperactivity is shown to deteriorate each day until delivery of the fetus. Gestation is shown parentheses in terms of weeks (w) and days (d) below the graph, after the number of hospital days. BT, body temperature; HR, heart rate; ICU, intensive care unit; IUFD, intrauterine fetal death; RR, respiratory rate.

Therefore, PSH can be considered to be prolonged and refractory in this patient. Pregnancy and IUFD may have played a major role in PSH exacerbation, considering that her symptoms deteriorated each day until delivery and dramatically ameliorated after delivery.

It is important to eliminate any risk factor for PSH exacerbation during the management of this condition. Not only pregnancy itself but also the limited use of medications because of the risk of adverse effects on the fetus is a factor that can exacerbate PSH. For example, gabapentin is considered effective for PSH management;[8] however, it can have teratogenic effects in pregnant women. Therefore, delivery not only eliminates exacerbating factors but also widens the treatment options.

We considered three possible mechanisms underlying the resolution of refractory PSH after delivery. First is relief from irritation of the sympathetic nervous system. Pregnancy brings about a variety of physiological and hormonal changes that can stimulate the sympathetic nervous system. In recent years, it has been believed that over-reactivity to afferent stimuli may be the hallmark of PSH. Second is the elimination of aggravating factors. The fetus, particularly a dead fetus, can be harmful to the mother. Finally, the resolution of a variety of immune system-mediated diseases, such as asthma, after delivery. Pregnancy results in the alteration of immune mechanisms. Therefore, immunological changes may have some influence on PSH, although the detailed mechanism remains unknown.

In conclusion, pregnancy and intrauterine fetal death can be risk factors for PSH exacerbation, and delivery can be useful to resolve refractory PSH and save the mother's life. Clinicians must be aware of these facts. Further reports should be accumulated to clarify the effects of pregnancy on PSH.

CONFLICTS OF INTEREST

NONE.

REFERENCES

1 Perkes I, Baguley IJ, Nott MT *et al*. A review of paroxysmal sympathetic hyperactivity after acquired brain injury. Ann. Neurol. 2010; 68: 126–35.
2 Rabinstein AA. Paroxysmal sympathetic hyperactivity in the neurological intensive care unit. Neurol. Res. 2007; 29: 680–2.
3 Baguley IJ, Nicholls JL, Felmingham KL *et al*. Dysautonomia after traumatic brain injury: A forgotten syndrome? J. Neurol. Neurosurg. Psychiatry 1999; 67: 39–43.

4 Fernandez-Ortega JF, Prieto-Palomino MA, Garcia-Caballero M *et al*. Paroxysmal sympathetic hyperactivity after traumatic brain injury: Clinical and prognostic implications. J. Neurotrauma 2012; 29: 1364–70.
5 Perkes IE, Menon DK, Nott MT *et al*. Paroxysmal sympathetic hyperactivity after acquired brain injury: A review of diagnostic criteria. Brain Inj. 2011; 25: 925–32.
6 Baguley IJ, Perkes IE, Fernandez-Ortega JF. Paroxysmal sympathetic hyperactivity after acquired brain injury: Consensus on conceptual definition, nomenclature, and diagnostic criteria. J. Neurotrauma 2014; 31: 1515–20.
7 Hughes JD, Rabinstein AA. Early diagnosis of paroxysmal sympathetic hyperactivity in the ICU. Neurocrit. Care 2014; 20: 454–9.
8 Baguley IJ, Heriseanu RE, Gurka JA *et al*. Gabapentin in the management of dysautonomia following severe traumatic brain injury: A case series. J. Neurol. Neurosurg. Psychiatry 2007; 78: 539–41.